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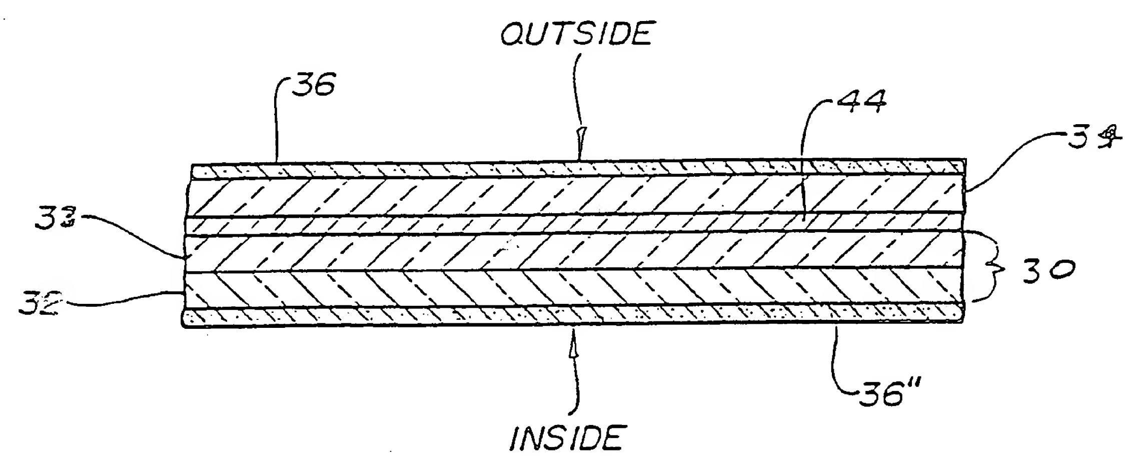

(57) Abstract

An antistatic sheet material and package formed therefrom is provided. The laminated sheet material includes a first inn layer (30) which is preferably a coextruded film having a polyolefin ply (32) and second copolymer ply (33) of ethylene-acryli acid copolymer, ethylene vinyl acetate copolymer, or blends thereof, a second intermediate layer (34) such as a polyester film ha ing an electrically conductive material (44) thereon, and an outer layer of an antistatic material (36). The laminate may be forme by hot roll lamination or an adhesive may be used between the first and second layers.

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ANTISTATIC SHEET MATERIAL, PACKAGE AND METHOD OF MAKING

This invention relates to an antistatic sheet material used for forming packages or the like for containing electrostatically sensitive components and protecting them from potentially damaging electrostatic charges, to packages formed therefrom, and to a method of making the same.

As electronic components and units have become increasingly more complex, while achieving ever smaller dimensions, the problem of damage to such components due to electrostatic discharge has become of major concern. The buildup of electrostatic charges on the packages for such components can result in the discharge of a spark which can arc over or otherwise damage or destroy the components.

Similarly, the medical and pharmaceutical industries have requirements for ultraclean instruments and drug substances. Packaging of such instruments and drugs is a problem because buildup of electrostatic charges on the packaging materials attracts dust and other contaminants from the air and surroundings. Such contaminants may become mixed with the chemicals of

drugs causing purity problems. Likewise, when the package is opened or the product poured out a static charge is generated on the product which may attract contaminates.

Accordingly, a number of packages and packaging materials have been developed which have antistatic properties. These antistatic packages have found wide use in a number of industries including the aerospace, chemical and pharmaceutical, and computer and electronics industries. Such packages are designed to prevent the buildup of electrostatic charges on the product contained therein, and may also be designed to provide protection against external electric fields.

Many packages have been fabricated of plastic films or sheets compounded with or coated with antistatic additives such a quaternary amines, amine salts or soaps and polyethylene glycols or ethers. These agents act as humectants, absorbing moisture from the air, to reduce friction within the package and static charge buildup on the package. However, such antistatic agents may not be permanent (i.e., may migrate to the surface and be lost from the plastic) and are humidity dependent.

Other packages have included one or more layers of conductive material to form a protective envelope or Faraday cage-type structure about the product. A Faraday cage may be defined as an electrostatic shield composed of a continuous mesh or series of interconnected electrical conductors which surrounds a defined volume of space.

Reference is made to U.S. Patent No. 4,756,414 issued on July 12, 1988. The antistatic sheet material and package there disclosed utilizes an electron beam curable antistatic material which is particularly advantageous in rendering antistatic the outer surfaces of the laminated material. However, the preferred process disclosed requires three separate electron beam treatment steps which are time consuming and costly. In addition, some problems in ply delamination, low seam strength, and excessive odor have on occasion been encountered.

Accordingly, the need exists for a more efficient method of producing a laminated antistatic sheet material and a laminated antistatic sheet material and package having improved properties.

The present invention meets that need by providing an improved method and resulting laminate antistatic sheet material which may be formed into a package for protecting electrostatically sensitive electronic components as well as sensitive chemicals, ultraclean instruments or other materials for which the build up of electrostatic charges may cause contamination or damage problems. For the purpose of this specification, reference to electrostatically sensitive components will include not only electronic parts and devices, but also sensitive chemicals and pharmaceuticals as well as other materials or instruments which have the potential of being damaged or contaminated by an electrostatic buildup or discharge.

According to one aspect of the present invention, a laminated antistatic sheet material is provided which includes an inner layer of a flexible

heat sealable plastic. The inner layer may be, for example, a single ply polyolefin film or a coextruded composite film having a first ply of a polyolefin such as polyethylene and a second ply of ethylene-acrylic acid copolymer, ethylene-vinyl acetate copolymer or a blend of the two. A second intermediate layer may be, for example, a polyester such as polyethylene terephthalate. The second layer has an electrically conductive material deposited thereon. An outer layer of an antistatic material is coated over the second layer or, alternatively, antistatic material may be incorporated into a polymer which is in turn coated over or laminated to the second layer. Antistatic properties may then be imparted to the inner and outer layers of the laminate by passing the laminate through an electron beam curing process.

An adhesive may be used between the second intermediate layer and the first inner layer. This is sometimes desirable and may be preferred, particularly when the first inner layer is a single ply polyolefin film rather than a coextruded composite film.

The laminated antistatic sheet material can be readily formed into a package by folding the sheet onto itself and heat sealing the opposing edges. Additionally, a closure device may be attached to or incorporated in the package. A preferred closure means is a releasable interlocking plastic zipper, the opposing rib and groove elements of which may be laminated to opposing inner faces of the sheet material adjacent the open end of the package.

A preferred method for fabricating the package includes the steps of providing a first layer of a

flexible heat sealable plastic material as described above having primary and secondary surfaces and a second layer of flexible plastic material which has primary and secondary major surfaces. An electrically conductive material such as a metal is preferably deposited on the primary major surface of the second layer. This deposition may be carried out using well known vacuum deposition or sputtering techniques. Alternatively, a number of conductive materials in sheet or web form are readily commercially available and may be used.

The first and second layers of the flexible sheet may be joined together by arranging the primary surfaces in a facing relationship and hot roll laminating. When a coextruded film having a copolymer ply and a polyolefin ply is used as the inner first layer, the copolymer ply faces the metallized surface of the second intermediate layer. Upon hot roll lamination the ethylene-acrylic acid copolymer or ethylene-vinyl acetate copolymer or copolymer blend of the copolymer ply forms a strong bond with the metallized second intermediate layer. When single ply polyolefin film is used as the inner first layer, then, it is desirable to use an adhesive, such as an ethylene-acrylic acid or ethylene-vinyl acetate adhesive between the inner first layer and the metallized second layer.

In either event, the metallized surface of the second intermediate layer faces inwardly and the polyester surface at this stage faces outwardly. Following lamination to form a sub-assembly, the polyester surface of the second intermediate layer is coated with an antistatic material which comprises an acrylate monomer-oligomer mixture containing an

alkylether triethyl ammonium sulfate. The antistatic material is cured by exposure to an electron beam.

The electron beam curing in the present invention may be done in a single pass following coating of the antistatic material on the laminated sub-assembly. Surprisingly, curing by exposure to an electron beam causes both exterior facing surfaces of the laminated sheet material to possess the effect of antistatic properties. This phenomenon occurs evidently because the antistatic properties of the antistatic coating material "bloom through" the laminate and appear on the opposite side, i.e. on the exterior facing surface which is the second major surface of the inner first layer. Alternatively, an antistatic material may be compounded directly into or coated directly on the second major surface of the inner first layer.

As mentioned, the second major surface of the inner first layer is preferably a polyolefin ply such as polyethylene which is heat sealable. By folding the laminated sheet material onto itself, the polyolefin surfaces are facing and heat sealing the edges will form a package.

The flexible sheet material and process for making it provide a flexible packaging material and package which has permanent antistatic properties on both the interior and exterior facing surfaces of a package. The metal layer or metallized layer is embedded in the multilayer structure and cannot flake off or peel when the package is flexed. It provides a Faraday cage to protect the contents of the package from external electric fields. The optional zipper closure means, which may also contain an antistatic agent and/or

semiconductive filler, secures the contents of the package from accidental spillage and brings the opposing faces of the open end of the package into close physical contact which enhances the Faraday cage protection. The result is a package which has permanent antistatic properties, is non-volatile, non-sluffing, non-humidity dependent, and otherwise offers a number of advantages over pre-existing antistatic packages.

Accordingly, the present invention provides an antistatic sheet material, package, and method for making the same which has permanent antistatic properties and protects the contents of the package from both electrostatic charge buildup within the package as well as from external electric fields.

Referring to the drawings, Figure 1 is a perspective view of a package formed in connection with the teachings of the present invention.

Figure 2 is a cross-sectional view taken along line 2--2 in Figure 1 illustrating in detail the optional zipper closure for the package;

Figure 3 is an enlarged cross-sectional view through one embodiment of the sheet material used to form the package of Figure 1;

Figure 4 is an enlarged cross-sectional view through another embodiment of the sheet material used to form the package of Figure 1;

Figure 5 is an enlarged cross-sectional view through another embodiment of the sheet material used to form the package of Figure 1.

Referring now to Figure 1, there is illustrated a package 10 which is the preferred form of package formed in accordance with the present invention. Other package, bag, pouches, and forms, including thermoformed containers and laminated containers, may be prepared from the antistatic sheet material of the present invention. Package 10 is shown as generally rectangular in shape, but may be formed into any convenient shape or size depending on the component or material to be contained therein. Package 10 includes two opposing walls 12 and 14 which comprise the laminated antistatic sheet material of the present invention described in greater detail below. In the preferred embodiment, package 10 is formed by applying releasable closure 24 to a web of the flexible sheet material, and folding the web of the flexible sheet material upon itself at fold line 16 to bring complementary rib and groove elements 26 and 28 into alignment. Opposing edges 18 and 20 are then heat sealed together and packages 10 severed from the web in a conventional manner.

As schematically illustrated in Figure 2, closure 24, adjacent opening 22, comprises an interlocking zipper having complementary rib and groove elements 26 and 28, respectively. While single rib and groove elements have been illustrated for simplicity, it will be apparent to those skilled in the art that other structures such as so-called Wide Track zippers with a plurality of complementary rib and groove elements may be used. Optional closure 24 is preferably extruded or laminated onto the sheet material prior to the formation of package 10. Preferably, an antistatic material and/or semiconductive filler is incorporated into closure 24.

Closure 24 may be used to enhance the Faraday-cage effect of the package by providing an electrical path through the zipper to opposite walls of the package. Preferably, closure 24 has a surface resistivity in the range of from 10^{12} to 10^{2} ohms/sq. Closure 24 is located approximately 0.24 to 4 inches (0.6 to 10 cms) and preferably 0.5 to 1.5 inches (1.27 to 3.8 cms) from open end 22 of package 10. Closure 24 may be omitted, or alternate closure means used, if so desired.

The preferred embodiment of the antistatic sheet material of the present invention which is used to form walls 12 and 14 of package 10 is illustrated in enlarged cross-section in Figure 5. The legends "Inside" and "Outside" have been added to the drawing to aid in the understanding of the invention. The side of the material labeled "Inside" is the inwardly facing surface of the material designed to be in contact with the contents of package 10 which is formed as described above. The "Inside" may also have closure 24 applied to it as illustrated in Figure 2. The side of the material labeled "Outside" is the exterior or outwardly facing surface of the multilayer material.

The most preferred form of the antistatic sheet material is shown in Figure 5. In the embodiment illustrated in Figure 5, the inner first layer 30 may be formed by an extrusion-coating process so that it has two sub-layers or plies 32 and 33. This offers a number of advantages over processes which involve lamination steps. First ply 32 is formed of a flexible heat sealable plastic. Second ply 33 is coextruded with first ply 32.

Ply 32 is preferably a polyolefin such as polyethylene (either high or low density, branched or liner), polypropylene homopolymers or copolymers, or polyolefin blends. Ply 33 may be a copolymer of ethylene and vinyl acetate, a copolymer of ethylene and acrylic acid and blends or mixtures of such copolymers.

Most preferably, first ply 32 is a blend of about 0 to 25 percent high density polyethylene and 25 percent to 100 percent liner low density polyethylene, by weight, and second ply 33 is a copolymer of ethylene and from 2 to 15 percent, and more preferably, 3 to 8 percent, acrylic acid. A material such as preferred first layer 30 is a coextruded material commercially available from The Dow Chemical Company under the designation Dow Adhesive Film. Ply 33 serves as the primary major surface of inner first layer 30. Ply 33 preferably makes up between 2 to 80 percent and most preferably about 10 to 20 percent of the total thickness of inner first layer 30. The total thickness of inner first layer 30 may be in the range from 1 to 20 mils (.025 to 0.15 mm) and preferably is approximately 2 to 4 mils (0.05 to 0.1 mm) for a package of the type shown in Figure 1. First layer 30 would be at the upper end of the range for a thermo-formed container.

Second, intermediate layer 34 is preferably a polyester such as polyethylene terephthalate. An electrically conductive layer 44 is deposited on the primary major surface of second layer 44. Second layer is preferably of a thickness between 25 gage (0.006 mm) and 1 mil (0.025 mm) and most preferably is either 48 (.012 mm) or 92 (.023 mm) gage material. Second layer 34 is preferably joined to first layer 30 by placing the respective primary major surfaces in a facing

relationship, i.e. electrically conductive layer 44 adjoins ply 33. A sub-assembly of first layer 30 and second layer 34 may, then, be formed by hot roll lamination.

An antistatic material 36 is coated on the secondary major surface of second layer 34. By "antistatic" material or agent, it is meant that the material or agent has properties which prevent the buildup of or cause the dissipation of static charges. Antistatic material 36 provides a surface conductivity in the range from 10^8 to 10^{12} ohms/sq., and preferably 10^{10} to 10^{11} ohms/sq. First layer 30 also has antistatic properties (illustrated by numeral 36") on its "Inside" surface. Such antistatic properties may be created by electron beam curing antistatic material 36 to cause antistatic properties 36" to appear on the Inside surface of first layer 30.

Alternatively, antistatic properties 36" can be achieved by coating an antistatic material onto first layer 30, incorporating an antistatic material into the polymer which makes up first layer 30, or incorporating an antistatic material into a polymer which in turn is coated over or laminated to first layer 30.

The preferred antistatic material for use in the present invention is an acrylate monomer-oligomer mixture containing an alkylether triethyl ammonium sulfate available from Metallized Products, Inc., Winchester, Massachusetts, under the name Staticure. The material is curable by exposure to an electron beam and cures to a permanent, non-bleeding coating which is not dependent on humidity for its antistatic effect. Further details concerning this antistatic material may

be found in British Patent Application No. 2,156,362, published October 9, 1985.

Alternatively, other known antistatic agents such as quaternary ammonium compounds or carbon may be utilized. These antistatic agents may be compounded with the polymers making up one or more layers of the sheet material, may be coated onto respective "Inside" and/or "Outside" surfaces of the sheet material, or may be compounded with a polymer which is then itself coated onto the respective "Inside" and/or "Outside" surfaces of the sheet material.

Electrically conductive layer 44 is preferably formed by depositing a thin layer of metal on layer 34. This deposition may be accomplished through the use of conventional vapor deposition of sputtering techniques. Preferred metals include aluminum, stainless steel, nickel, copper, and mixtures thereof. Layer 34 may be pretreated to render it more receptive to metallization. Optionally, electrically conductive layer 44 may be a coated or laminated metal rigid or mesh, a metal filled plastic film, or other conductive material.

Layer 44, if vacuum deposited or sputtered, is preferably about 50 to about 200 Angstroms thick, and most preferably about 100 Angstroms thick. Its surface resistivity is preferably about 100 ohms/sq. The coating may be discontinuous and/or have pinholes therein with no substantial adverse effect on the Faraday-cage structure which results when the package is formed.

It is preferred that the combination of layers in the laminate be partially transparent or transparent

to permit visual inspection of the contents of the package without the need for opening the package. Opening of the package outside of a controlled environment which allows for discharge of any static charge buildup may be detrimental. Accordingly, the ability to make a visual inspection of a packaged component, including any part or control numbers included in the package, is desirable. It is also possible to have one wall of the package partially transparent or transparent (through which the component may be inspected) and the other wall opaque. For example a cushioning layer, such as a foamed plastic film, may be laminated to, or included in, wall 12 or 14 while the other wall remains as described. In the preferred embodiment where both walls are transparent, the walls of package 10 are made up of the two principal layers.

In the alternative embodiment illustrated in Figure 4, where like elements are identified by like reference numerals, the sheet material comprises a first layer 30, a second layer 34', and a conductive layer 44. Second layer 34' is formed of a flexible plastic having primary and secondary major surfaces 40 and 42, respectively. Second layer 34' has deposited on its primary major surface 40, a layer of an electrically conductive material 44. the secondary major surface 42 has antistatic properties illustrated by numeral 36'.

In this instance second layer 34' is preferably a polyester, but may also be a thermoplastic polyurethane, nylon, or a polyolefin such as polyethylene or polypropylene polymers or copolymers,

including copolymers of ethylene and acrylic acid or vinyl acetate.

The two layers 30 and 34' may be bonded together along their respective primary major surfaces through the use of an adhesive 46. Adhesive 46 may be a solvent or water based adhesive. Adhesive 46 may also be a thermoplastic adhesive and/or electron beam curable adhesive. Preferred is an ethylene-vinyl acetate copolymer or ethylene-acrylic acid copolymer adhesive.

In the alternative embodiment shown in Figure 3, first layer 30 is a single ply film, preferably a polyolefin such as polyethylene. As in Figure 4, adhesive 46 is used to join first layer 30 to the metallized primary major surface of second layer 34'.

A preferred method of making the laminated antistatic sheet material of the embodiment illustrated in Figure 5 includes the following steps. Second layer 34, which is preferably a polyester such as 48 or 92 ga. (.012 or .023 mm) polyethylene terephthalate is metallized on its primary major surface with an electrically conductive layer 44, which may be deposited on layer 34 by sputtering or vacuum deposition to approximately a 50 percent light transmission. Alternatively, a metallized plastic which is commercially available may be utilized.

First layer 30 which is preferably a 824 Dow Adhesive Film available from the assignee of the present invention having plies 32 and 33 as described is joined to second layer 34 with the primary major surfaces facing. Hot roll lamination between rolls having an interference on the order of .030 inch (0.08 mm) for a

preferred thickness sub-assembly of 2 to 5 mils (0.05-0.127 mm) at 200 to 400°F (93 to 204°C) for .2 to 2 milliseconds is used to securely bond the two layers together to form a sub-assembly. Antistatic material 36, preferably Staticure coating from Metallized Products, Inc., is then applied onto the secondary major surface of layer 34 at a coat weight of between 2 lbs and 8 lbs. (0.9 to 3.6 kgs) per ream (3000 sq. feet (278.7 sq. meters)) using standard coating equipment. The coating is then cured using an electron beam dosage at 1 to 7 megards.

During this curing step antistatic properties are produced on both the secondary major surface of layer 34 and the secondary major surface of layer 30. This phenomenon is discussed in "EB-curbale Coating is Clear Cure for Static", Converting Magazine, March 1985, and "Electron Beam Radiation Cured Coatings for Static Control," Evaluation Engineering, September 1985. That is, the "Inside" surface of layer 30, following curing of antistatic material 36, now shows antistatic properties (illustrated by numeral 36") even though no antistatic material was originally coated directly thereon. Of course, it is possible in an additional step to also coat antistatic material on the "Inside" surface of layer 30. The preferred process is illustrated by the Example 1 below.

Example 1

A coextruded sheet material, 824 Dow Adhesive film (DAF), was laminated to metallized polyethylene terephthalate (PET) sheet material by hot roll laminating with the objective that: the electrical continuity of the metallized surface be maintained, the

cure be minimized, the adhesion strength between the two sheet materials be greater than .3 lbs./inch (0.14 kgs/2.54 cm) and the material should be as wrinkle free as possible. Eight hundred (800) yards (732 meters) of prime material were produced in less than thirty minutes by hot roll laminating a 92 ga. metallized PET to a 3 mil (.088 mm) thick 824 DAF. An approximately four mil (0.1 mm) thick laminated sheet material (sub-assembly) was produced. Electrical continuity of the metal surface was maintained in the laminated sheet material and excellent adhesion of the DAF to the metallized PET was achieved. In fact, delamination strength could not be determined because the sample could not be delaminated without destruction.

Seven hundred and fifty (750) feet (229 meters) of the laminated sheet material were coated with Staticure antistatic material (15 percent active antistatic ingredient) from Metallized Products, Inc. on 18" (45.7 cm) wide pilot scale equipment consisting of a film unwind stand, a corona treatment roll stack, a gravure coating system, an Energy Sciences electron beam curing system and a film winder. Two coating thickness, namely approximately 2.5 lbs. (1.14 kg)/ream and 3 lbs (1.4 kgs)/ream were achieved using a 110 Q gravure roll and a 150 Q gravure roll, respectively. The material was run at 100 ft (30.5 meters)/min. which resulted in a 2 megarad radiation dose. The curing atmosphere was held constant at N_2 with less than 200 ppm O_2. Coating adhesion was excellent. Electron beam processing did not effect the laminated sheet material's superior resistance to delamination. The resultant antistatic laminated sheet material had a surface resistivity as set forth in Table 1 below:

Table 1
Surface Resistivity in Ohms per Square

		Sheet Material of U.S. Patent No. 4,756,414	Run Using 110 Ω Roll	Run Using 150 Ω Roll
Conditioned*	Coated	1.9×10^{11}	1.3×10^{11}	7.6×10^{10}
	Uncoated	1.0×10^{11}	5.3×10^{11}	1.6×10^{12}
Aged** & Coated	Coated	4.0×10^{11}	2.0×10^{11}	1.7×10^{11}
	Uncoated	1.7×10^{11}	2.9×10^{11}	1.8×10^{12}

*Conditioned = 48 hours at 12% relative humidity, RTP.
**Aged = 2 days at 60°C

When folded upon itself and heat sealed, the seam strength was 14 lbs./inch. No odor was observed.

Example 2

Similar results have been observed when an adhesive is used between a polyethylene inner first layer and a metallized PET second layer. Such a structure is illustrated by Figure 3. Thus an appoximately 3 mil (0.08 mm) thick laminated sheet material was produced from 1/2 mil (0.01 mm) thick metallized PET adhered to a 2.3 mil(.06 mm) polyethylene film (DOW LDF 318 available from the assignee of the present invention) using an electron beam curable adhesive approximately .2 mil (.005 mm) thick. The adhesive was cured by exposure to two megarads resultant from 175 KV at a line speed of 100 ft (30.5 meters)/min

with a 110 Q gravure cylinder (approximately 4 lb (1.8 kg)/ ream coat weight).

The uncoated subassembly film laminate had a high exterior surface resistivity (insulative). However, after coating the PET surface with Staticure antistatic material and electron beam curing as in the Example 1, the surface resistivity of the laminate was found to be 7 x 10^{10} ohms/square on the coated surface, and 7x 10" ohms/square on the opposite surface.

Similar results were obtained when a 1 mil thick metallized PET sheet containing laminate was coated with Staticure using an 85 Q cylinder, the coated side resistivity was found to be 2 x 10^{10} ohms/square and the opposite side resistivity was found to be 6 x 10^{10} ohms/square.

The laminated sheet material of Example 1 and Example II was formed into individual packages as previously described. The resulting packages exhibited good puncture and abrasion resistance. Such package are especially useful to protect electronic circuit boards and other electronic components having exposed wire ends.

CLAIMS :

1. A laminated sheet material containing electrostatically sensitive components comprising:

a) a first inner layer of a coextruded film having a polyolefin ply and a ply of a copolymer of ethylene-acrylic acid, ethylene-vinyl acetate or blends thereof,

b) a second intermediate layer having an electrically conductive material deposited thereon laminated to the first inner layer and adjoining the copolymer ply, and

c) an outer layer of an antistatic material, the outer layer being located on the side of the second layer opposite the first inner layer.

2. The laminated sheet material of Claim 1 in which the inner layer has antistatic properties.

3. The laminated sheet material of Claim 2 in which the antistatic material is a cured acrylate monomer-oligomer mixture containing an alkylether triethyl ammonium sulfate.

4. The laminated sheet material of Claim 1 wherein the second intermediate layer is a polyester film.

5. The laminated sheet material of any one of Claims 1 to 4 wherein the electrically conductive material on said second intermediate layer adjoins an ethylene-acrylic acid copolymer ply of the first inner layer.

6. The laminated sheet material of Claim 5 in which the electrically conductive material is aluminum, stainless steel, nickel, copper, or a mixture thereof.

7. Laminated sheet material of Claim 6 wherein a layer of adhesive is disposed between the first layer and the second layer bonding the first layer to the second layer with the copolymer ply adjoining the layer of adhesive.

8. The laminated sheet material of Claim 7 in which the polyolefin ply is a polyethylene film.

9. A package adapted to receive and protect an electrostatically sensitive component, the walls of the package being formed of an antistatic sheet material of any one of Claims 1 to 8 the package being formed by joining the walls together along opposing side edges of facing first inner layers of the antistatic sheet material.

10. The package of Claim 9 including releasable, interlocking closure means on opposing inner faces of one end of the walls.

11. A method of fabricating an antistatic sheet material comprising the steps of:

a) providing a first inner layer of a coextruded film having a polyolefin ply and a ply of a copolymer of ethylene-acrylic acid, ethylene-vinyl

acetate copolymer or blends thereof, and a second layer of flexible plastic material having a primary major surface and a second layer of flexible plastic material having a primary major surface and a secondary major surface,

b) depositing an electrically conductive material on the primary major surface of the second layer,

c) laminating the first inner layer to the second layer with the copolymer ply adjoining the electrically conductive material,

d) coating an outer layer of antistatic material over the secondary major surface of the second layer, the antistatic material comprising an electron beam curable mixture, and

e) curing the antistatic material by exposing it to an electron beam, the curing step causing said antistatic material to provide antistatic properties to the first inner layer.

12. The method of Claim 11 wherein the electron beam curable mixture is a acrylate monomer-oligomer mixture containing an alkylether triethyl ammonium sulfate and the second layer is a polyester film.

FIG-1

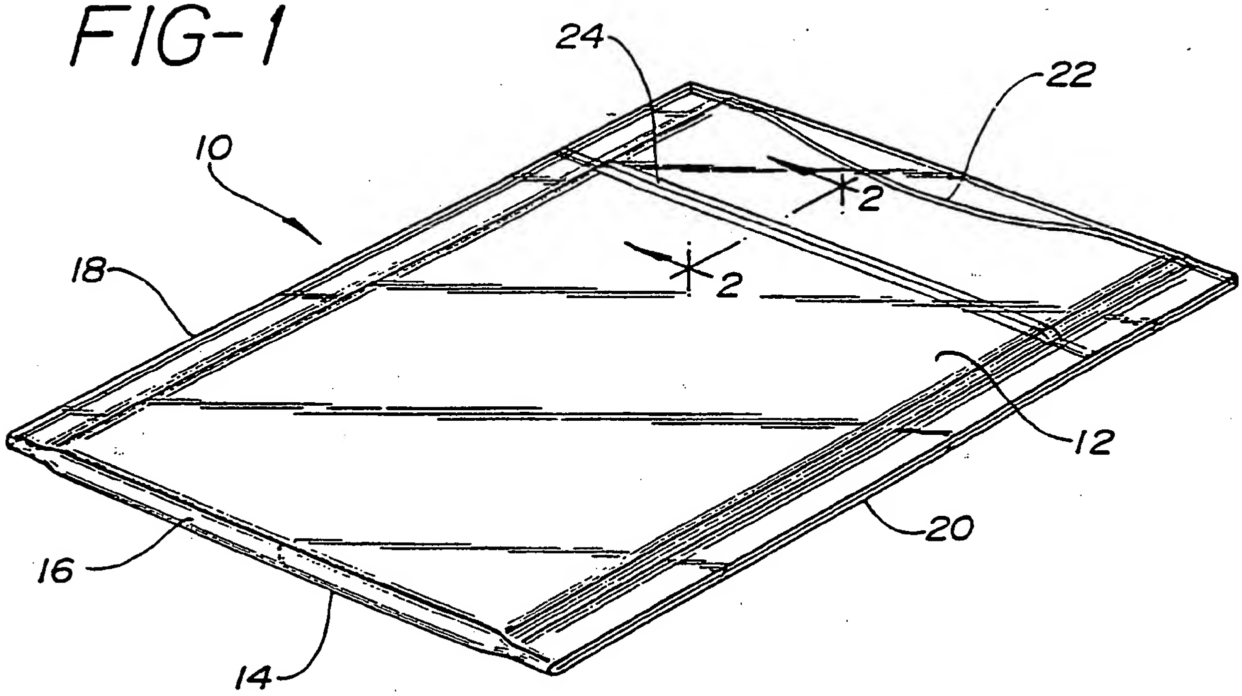


FIG-2

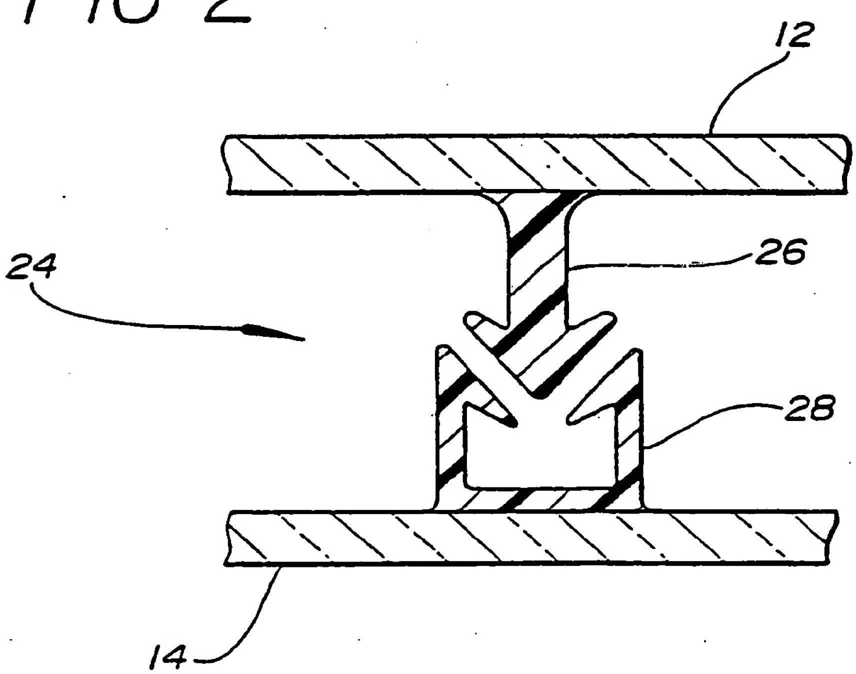
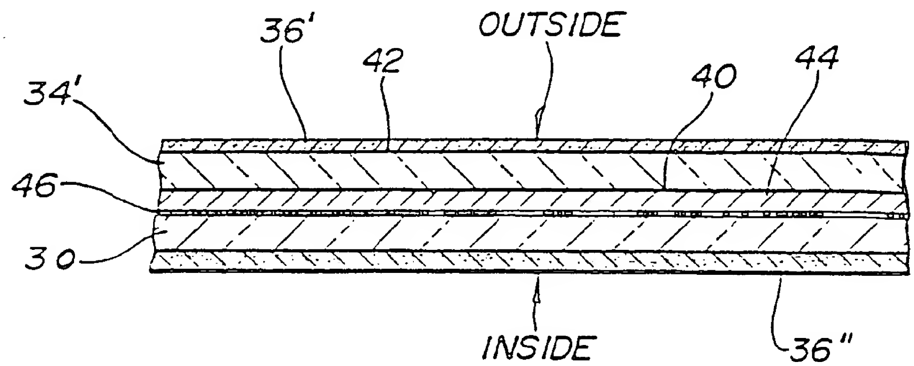


FIG-3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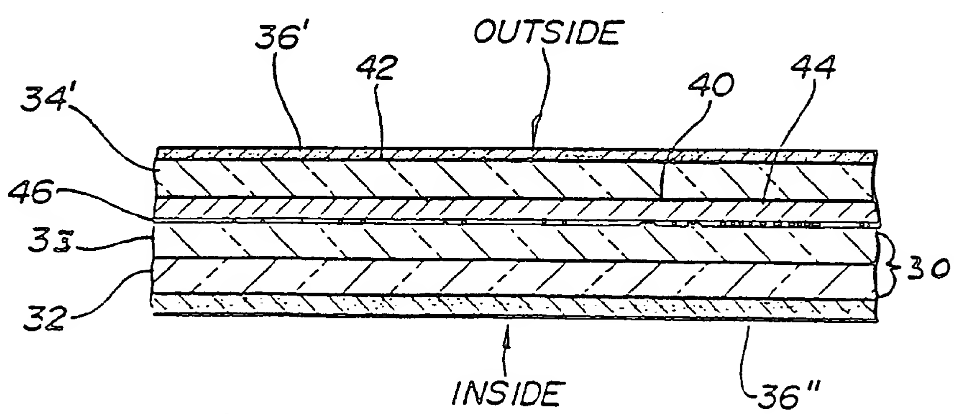
44
34'
46
30
INSIDE
36"

FIG-4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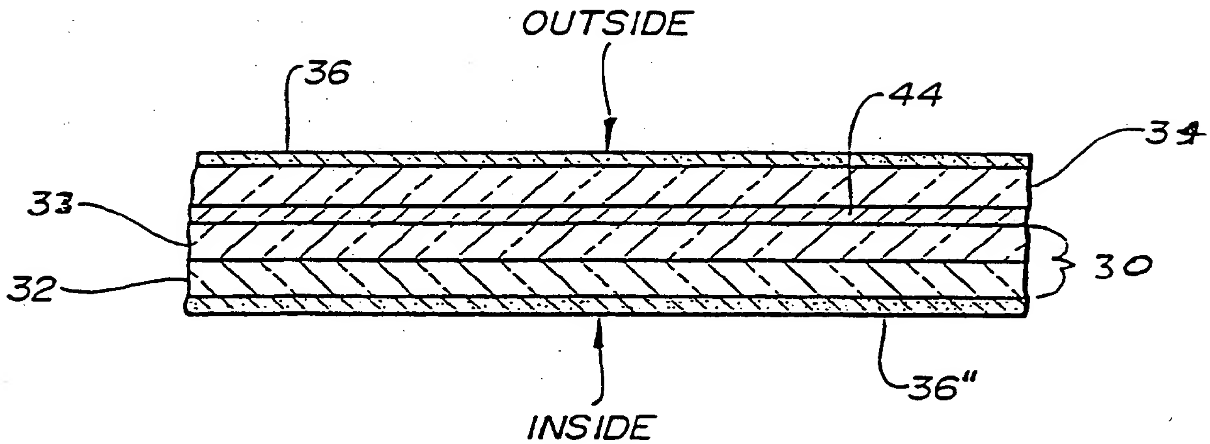
36"

FIG-5



INTERNATIONAL SEARCH REPOR.

International Application No. PCT/US89/05161

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5 B65D 30/08, B32B 27/08, B32B 31/04
U.S. CL. 206/328, 156/272.2, 361/212, 427/44, 428/35.2, 35.3, 458, 483, 520, 922

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
U.S.	206/328, 156/244.11, 272.2, 361/212 427/44, 428/35.2, 36.3, 458, 483, 520, 922

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 4154344 Yenni, Jr. et al 15 May 1979	1-12
A	US, A, 4156751 Yenni, Jr. et al 29 May 1979	1-12
A	US, A, 4424900 Petcavich 10 January 1984	1-12

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
22 January 1990	27 FEB 1990
International Searching Authority	**Signature of Authorized Officer**
ISA/US	James J. Seidleck

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